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IS 4473 (2002): Domestic Gas Ovens for Use with Liquefied Petroleum Gases - [MED 23: Domestic and Commercial Gas Burning Appliances]

“ज्ञान से एक नये भारत का निर्माण”

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( पहला पुनरीक्षण )

*Indian Standard*  
DOMESTIC GAS OVENS FOR USE WITH  
LIQUEFIED PETROLEUM GASES — SPECIFICATION  
( *First Revision* )

ICS 75.160.30; 97.040.20

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BUREAU OF INDIAN STANDARDS  
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG  
NEW DELHI 110002

## FOREWORD

This Indian Standard (First Revision) was adopted by Bureau of Indian Standards, after the draft finalized by the Domestic and Commercial Gas Burning Appliances (Pressure Type) Sectional Committee had been approved by the Mechanical Engineering Division Council.

This standard was first published in 1967. Since then many suggestions were received for its improvement and with the result, Amendments No. 1, 2 and 3 were issued. This standard is being revised to incorporate the amendments issued and the suggestions received from time to time.

With the availability of bottled liquefied petroleum gases in big cities for cooking purpose, more gas ovens are being accepted for household use, for their better and quicker service. With a view to help the manufacturers to cater to various consumer tastes, this standard has been formulated in such a way that it does not limit the design, materials and methods of manufacture and any appliance complying with the requirements laid down would be acceptable.

This standard, dealing with the domestic gas ovens for use with LPG, is one of a series of Indian Standards on various domestic and commercial gas burning appliances (pressure type). General requirements of this equipment are covered in IS 5116:1996 'General requirements for domestic and commercial equipment for use with LPG (*third revision*)' which is a necessary adjunct to this standard. Should, however, any deviation exist between the requirements given in IS 5116 and those of this standard, provision of the later shall apply. Other standards published so far in the series are IS 4246 : 2002 'Domestic gas stoves for use with liquefiable petroleum gases (*fifth revision*)', IS 4760 : 2002 'Domestic cooking ranges for use with liquefiable petroleum gases (*third revision*)' and IS 11480 : 1998 'Domestic grillers for use with liquefiable petroleum gases (*first revision*)'.

In preparing this standard, assistance has been derived from BS 2491 : 1963 'Specification for domestic cooking appliances for use with liquefied petroleum gases', issued by the British Standards Institution.

Assistance has also been taken from EN 30 : 1979 'Domestic cooking appliance burning gas' published by European Committee for Standardization. The deviations are given in Annex A. It may be noted that gas stove which passes as per IS 4246 will pass all the requirements of categories  $II_{23}$ ,  $II_{2HL3}$ ,  $II_{2H3}$  and  $II_{2L3}$  appliances specified in EN 30 : 1979.

The composition of the Committee responsible for the preparation of this standard is given in Annex E.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be same as that of the specified value in this standard.

**AMENDMENT NO. 2 SEPTEMBER 2005  
TO  
IS 4473 : 2002 DOMESTIC GAS OVENS FOR  
USE WITH LIQUEFIED PETROLEUM GASES —  
SPECIFICATION**

*(Second Revision)*

(Page 3, clause 13.1) — Substitute the following for the existing:

‘13.1 Drop doors shall be such that when opened fully, they shall lie and remain essentially in a horizontal position. All side-hinged oven doors shall open through at least 100°.’

(ME 23)

**AMENDMENT NO. 1 JULY 2004**

**TO**

**IS 4473 : 2002 DOMESTIC GAS OVENS FOR  
USE WITH LIQUEFIED PETROLEUM GASES —  
SPECIFICATION**

*(First Revision)*

*'2 452 kN/m<sup>2</sup> (25 gf/cm<sup>2</sup>)', and wherever appears in the text.*

*(Page 4, clause 21, lines 4 and 5) — Substitute '2.452 kN/m<sup>2</sup> (25 gf/cm<sup>2</sup>)' for  
3.432 kN/m<sup>2</sup> (25 gf/cm<sup>2</sup>) to 35 gf/cm<sup>2</sup>', for '2 452 kN/m<sup>2</sup> to  
(25 gf/cm<sup>2</sup>) to 35 gf/cm<sup>2</sup>', and wherever appears in the text.*

**(MED 23)**

## Indian Standard

# DOMESTIC GAS OVENS FOR USE WITH LIQUEFIED PETROLEUM GASES — SPECIFICATION (First Revision)

### 1 SCOPE

1.1 This standard specifies construction, operation, safety requirements and tests for domestic ovens of capacity not exceeding  $100 \text{ dm}^3$ , intended for use with liquefied petroleum gases at  $30 \text{ gf/cm}^2$  gas inlet pressure.

NOTE — The capacity of the oven shall be area of the inner surface of the oven door in square decimetres multiplied by the total inner depth of the oven in decimetres, measured from the front to the rear wall of the oven.

1.1.1 For convenience, this standard has been divided into three sections as follows:

- Section 1 Construction
- Section 2 Performance
- Section 3 General

### 2 REFERENCES

The standards listed in Annex B contain provisions, which through reference in this text constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are

subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards.

### 3 TERMINOLOGY

For the purpose of this standard, definitions given in IS 6480 shall apply.

### SECTION 1 CONSTRUCTION

#### 4 GENERAL

4.1 In addition to the relevant requirements given in 4 of IS 5116, the requirements given in 4.2 and 4.3 shall apply.

4.2 The oven, including all the components shall be soundly constructed and of a high standard of workmanship and appropriate finish. The construction shall ensure durability and shall comply with the safety requirements (see Fig. 1).

4.3 No pressure regulator shall be included as a part of the range.

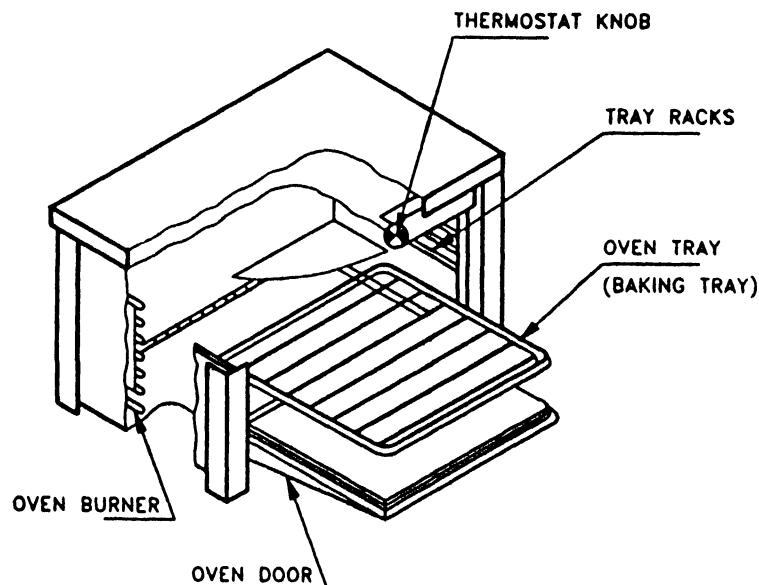


FIG. 1 OVEN DETAILS

## 5 MATERIALS

**5.1** In addition to the relevant requirements given in 5 of IS 5116, the requirements given in 5.2 shall apply.

**5.2** Gas cocks, taps and other components shall be made of the material given below:

Components	Manufacturing Process	Material	Conforming to
Body, plugs and washers	Hot forged or Cast	Brass bars or Brass casting	IS 3488 or Grade 3 of IS 292 or Class V of IS 1458
Nuts, screws, and pins	Machined	Free-cutting brass rods	IS 319
Washers	Cold pressed	Brass	IS 410

## 6 DESIGN FOR MAINTENANCE

**6.1** In addition to the relevant requirements given in 6 of IS 5116, the requirements given in 6.2 to 6.5 shall apply.

**6.2** The appliance, including all the component parts, shall be easy to clean and to maintain in good working order. There shall be easy access to the accessories and controls for maintenance and adjustment.

**6.3** Burners and parts of burners of the same capacity shall be interchangeable or replaceable without affecting performance.

**6.4** Parts, which are intended to be removable by the user, shall be easy to replace correctly, and incapable of being assembled incorrectly.

**6.5** All nuts, bolts and fittings having spanner flats shall be capable of being moved by suitable spanner or be readily accessible to an adjustable spanner.

## 7 RIGIDITY AND STABILITY

**7.1** The oven shall be so designed that it remains stable and shall not be easily overturned.

**7.2** Any rack or baking tray fitted in an oven shall not tip down excessively if it protrudes from the oven for two-thirds of the way and a weight of 3 kg is placed in the middle of it.

**7.3** Construction of portable ovens which are designed to be used with or without bases or legs shall be such that the combustion shall not be affected when the legs are detached or the base removed and the oven is set directly on the floor.

**7.4** It shall be level and shall not rock when placed on the level surface.

## 8 WORKMANSHIP AND FINISH

**8.1** In addition to the relevant requirements given in 7 of IS 5116, the requirements given in 8.2 and 8.3 shall apply.

**8.2** All components made of materials susceptible to corrosion shall be given a corrosion resistant protective finish appropriate to the conditions of use. The protective coating for external surfaces shall be resistant to temperature up to 150°C and for internal oven surface up to 400°C.

**8.3** Concealed gas tubes and fittings liable to corrosion shall be protected by bituminous paint or other equally protective material.

## 9 GAS TAPS

The relevant requirements given in 8 of IS 5116 shall apply.

## 10 INJECTOR JETS

The relevant requirements given in 9 of IS 5116 shall apply.

## 11 BURNERS

**11.1** In addition to the relevant requirements given in 10 of IS 5116, the requirements given in 11.2 to 11.5 shall apply.

**11.2** For burners having centre flame, provision shall be made to protect the centre flame from pans resting directly on burner top and smothering the centre flame.

**11.3** The oven shall have one burner having a rating of at least 1 490 kcal/h, based on net calorific value of the gas (when using commercial LPG).

**11.4** If a pilot burner is fitted, it shall be easily removable for cleaning. All pilot flames shall be protected as far as possible by design and position against flame diminution or extinction by draught, products of combustion, overheating, condensation, corrosion or matter falling from above.

**11.4.1** If pilot burner is provided, the gas inlet to the pilot burner and the main burner shall close, if the pilot burner gets extinguished.

**11.5** The handle of the tiltable oven burner shall be clearly visible and easy to operate.

## 12 FLUE OUTLET

The exit for products of combustion from the oven shall be protected by suitable design against accidental blockage. The final discharge aperture for the oven

products of combustion shall also be protected by suitable design for preventing accidental blockage. The fluing of the oven products shall be so arranged that no greasy vapours are deposited on the wall behind the oven.

### 13 DOORS

**13.1** Drop doors shall be such that when opened fully, they shall lie and remain essentially in a horizontal position. All side-hinged oven doors shall open through at least 100°C.

**13.2** The doors and hinges shall show no sign of crack or permanent distortion when tested as detailed in 13.2.1 and 13.2.2.

#### 13.2.1 For Doors Opening Downwards

- a) A load of 10 kgf shall be applied uniformly on an area of 30 cm<sup>2</sup> for 5 min at one corner of the door, the other corner being solidly supported as shown in Fig. 2a; and
- b) A load of 20 kgf shall be uniformly applied on a strip of 10 cm width, running centrally, for 5 min as shown in Fig. 2b.

#### 13.2.2 For Door Opening Sideways

A load of 20 kgf shall be applied uniformly over the top edge of the door for 5 min as shown in Fig. 2c.

### 14 OVEN FLAME INSPECTION

**14.1** For ovens not fitted with thermostats, it shall be possible to see the oven flame while adjusting the tap. This may be done with door open or close position.

### 15 INSULATION

**15.1** When insulation is employed, it shall neither be exposed to air nor to flue products and it shall be uniformly and tightly packed to provide even protection and to prevent shifting.

**15.2** Granular insulation shall not be used unless adequately protected against setting during transportation or normal use.

### 16 GAS THERMOSTAT

**16.1** In addition to the relevant requirements given in 15 of IS 5116, the requirements given in 16.2 to 16.6 shall apply.

**16.2** Thermostat shall be easy to operate at all temperatures normally attained in use.

**16.3** The minimum gas flow through any thermostat by-pass shall be controlled by an orifice easily removable for cleaning. The fixed minimum by pass shall be sufficient to maintain stable flames on the main burner at 2 452 kN/m<sup>2</sup> (25 gf/cm<sup>2</sup>) gas inlet pressure.

**16.4** If the thermostat includes a device for controlling the pilot gas rate, it shall be easily removable for cleaning.

**16.5** All thermostats shall have a suitable filter in the line before the gas valve.

**16.6** The numbers or letters indicating the various thermostat settings shall be plainly and durably marked.

### 17 GAS INLET CONNECTION

**17.1** In addition to the relevant requirements given in 18 of IS 5116, the requirements given in 17.2 shall apply. Inlet connection at the rear end is also permitted.

**17.2** The position of the gas inlet shall allow connection to a gas supply on either side of the appliance with the appliance fitted tight against a back wall. Ample clearance shall be provided to afford easy manipulation of standard tools when connecting the appliance to the supply line.

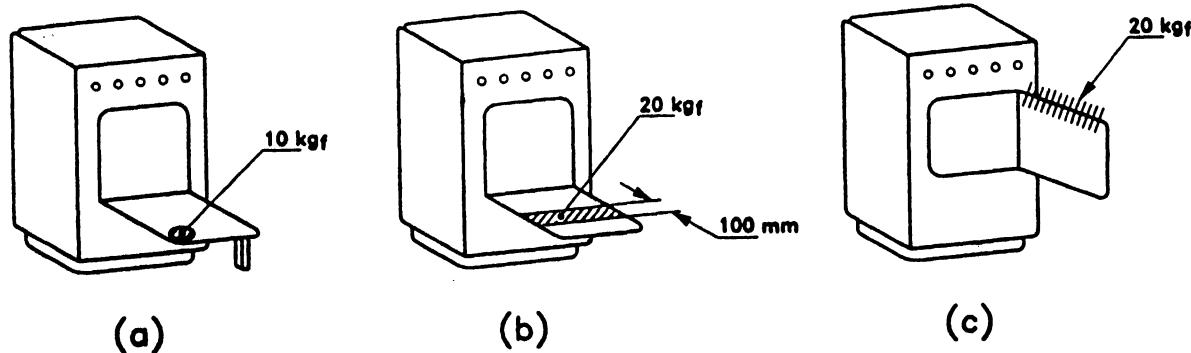


FIG. 2 DOOR TESTING OF OVENS

## 18 GAS SOUNDNESS

18.1 The relevant requirements given in 16 of IS 5116 shall apply.

## 19 STRENGTH OF APPLIANCE

19.1 The oven shall support without breakage or apparent damage from a load of 50 kgf, uniformly applied on the top. After a period of 15 min the load shall be removed and the base and frame examined for any sign of breakage or permanent deformation.

## SECTION 2 PERFORMANCE

### 20 GENERAL CONDITIONS OF TEST

20.1 The relevant requirements given in 19 of IS 5116 shall apply.

### 21 IGNITION AND FLAME STABILITY

21.1 In addition to the relevant requirements given in 21 of IS 5116, the requirements given in 21.2 to 21.4 shall apply.

21.2 There shall be easy and safe access for lighting and re-lighting each burner by a match stick and it shall be easy to see that the burner is alight. Where the burner or burners are lighted by automatic ignition (battery or flint-operated) by a pilot flame, it shall not be possible for gas to be admitted to the main burner without being smoothly ignited by the pilot flame. Each burner should be at room temperature at the start of each test and should be tested in turn.

21.3 If a flame is applied to any of the outer row of burner ports when the gas is flowing, flame travel shall be complete. This applies for all the pressures from 2 452 kN/m<sup>2</sup> to 3 432 kN/m<sup>2</sup> (25 gf/cm<sup>2</sup> to 35 gf/cm<sup>2</sup>) taps being fully opened and without a pan over the burner. Burners consisting of two separate tubes, each requiring separate lighting are acceptable on oven.

21.4 When the burner is ignited from a pilot flame, and/or by an electric/electronic method, the ignition shall be smooth at pressure from 2 452 kN/m<sup>2</sup> to 3 432 kN/m<sup>2</sup> (25 gf/cm<sup>2</sup> to 35 gf/cm<sup>2</sup>) with the burner tap turned full 'ON' and ignition shall be effected without undue delay after turning on taps.

21.5 When flame failure devices are used, these shall open fully from cold in not more than 90 s and shall close from the fully heated condition within 90 s.

## 22 RESISTANCE TO DRAUGHT

Flame of the oven burner at full 'ON' shall not

extinguish when the door is opened or closed abruptly. Oven burners on the by-pass rate, if fitted with a thermostat or at the rating to give an oven temperature of 120°C above room temperature if no thermostat is fitted, shall not be extinguished when the door is opened and closed with reasonable care.

## 23 THERMOSTATS

23.1 In addition to the relevant requirements given in 21.6 of IS 5116, the requirements given in 23.2 to 23.5 shall apply.

23.2 The thermostat shall be such that the temperature in the centre of the oven with a gas inlet pressure of 3 432 kN/m<sup>2</sup> (35 gf/cm<sup>2</sup>) is not more than 8°C in excess of the temperature obtained by the moving with a gas inlet pressure of 2 942 kN/m<sup>2</sup> (30 gf/cm<sup>2</sup>) from any setting of thermostat. This requirement shall be tested by method given in C-1.1.

23.3 The thermostat shall be such that the two temperatures obtainable in an oven for each setting, that is, that obtained by the moving from a higher to the required setting and that obtained by moving from a lower to the required setting, do not differ by more than 6°C. This requirement shall be tested by method given in C-1.2.

23.4 The burners of the oven fitted with thermostats shall be stable when after operating in the highest position, to enable the temperature equilibrium to be contained, the control is turned sharply to its lowest position at a gas inlet pressure of 2 452 kN/m<sup>2</sup> (25 gf/m<sup>2</sup>). This requirement shall be tested by method given in C-1.3.

23.5 It shall be possible to meet the requirements given in 24 with oven tap fully open, by adjustment of the thermostat settings wherever necessary.

## 24 OVEN HEAT DISTRIBUTION

24.1 It shall be possible to raise the temperature in the middle of the oven to 210°C above room temperature in 14 min, with the baking tray placed between one-third and one-half the heights of the oven measured from the oven floor. The temperature measurement shall be made by means of a thermocouple placed in the centre of 50 mm dia blackened copper sphere (see Fig. 3).

24.2 It shall be possible to adjust the gas consumption so that the oven can be kept at a temperature, which is not higher than 120°C above room temperature with the baking tray placed between one-third and one-half the heights of the oven measured from the base. If the oven is provided with a fixed low position, this test shall be satisfied with the tap on the low setting. The temperature measurement shall be made by means of

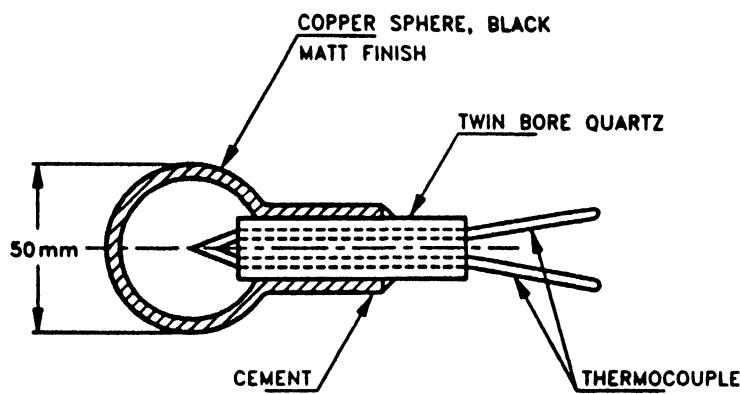


FIG. 3 RADIANT COPPER SPHERE FOR OVEN TEMPERATURE MEASUREMENT

a thermocouple placed in the center of the blackened copper sphere as given in 24.1.

**24.3** It shall be possible to raise the temperature in the middle of the oven to 260°C above room temperature using at the most 100 g of butane (1 090 kcal), the baking tray being placed between one-third and one-half the heights of the oven measured from the base. This is applicable only to oven from 10 dm<sup>3</sup> to 55 dm<sup>3</sup> capacity.

**24.4** The quantity of gas necessary to maintain in the middle of the oven, a temperature of 210 °C above room temperature for one hour shall not exceed the values given below, the baking tray being placed between one-third and one-half the height of the oven measure from the base:

Quantity of Gas	Calorific Value	Oven Capacity
95	1 035	20
110	1 200	25
125	1 363	30
135	1 470	35
150	1 635	40
175	1 908	50
185	2 016	55
195	2 125	60
215	2 344	70
235	2 562	80
250	2 725	90
265	2 888	100

**24.5** With a temperature in the center of the oven maintained at 210°C above room temperature, the temperature measured above the baking tray in any position in any horizontal plane shall not vary by more than 10 percent from the average temperature of that plane. This shall not be necessary when satisfactory cooking is established.

**24.6** The operation of the oven shall not give rise to any obnoxious fumes.

#### 25 VICTORIA SANDWICH CAKE BAKING TEST

**25.1** Ovens of capacity up to 30 dm<sup>3</sup> shall bake one cake of 18 cm dia; ovens of capacity 31 dm<sup>3</sup> to 75 dm<sup>3</sup> shall bake two cakes of 18 cm dia each concurrently; and ovens of capacity 76 dm<sup>3</sup> to 100 dm<sup>3</sup> shall bake two cakes of 23 cm dia each concurrently. The details of test are mentioned below:

*Ingredients* — The following ingredients shall be sufficient to make one 23 cm dia or two 18 cm dia cakes:

Flour	120 g
Baking powder	10 g
Butter	120 g
Sugar	120 g
Eggs	2

One table spoonful of water and a pinch of salt.

*Method* — The sugar and butter shall be creamed with a wooden spoon to the consistency of whipped cream and each egg shall be beaten in separately. Baking powder and salt shall be folded in the sifted flour using a metal spoon and water added to it. When two cakes are to be made, the mixture shall be equally divided between two tins and shall be placed on separate shelves in the oven. Baking shall be carried out according to the recommendation of the manufacturer of the oven. One tin shall be allowed to be removed first from the oven and the other tin moved into its place but no other adjustments shall be permitted. The location and orientation of the cakes in the oven shall be noted. The cakes, after removal from the oven, shall be left for cooking on a rack.

**Assessment of Results** — The results of the test shall be assessed as given below:

<i>Dia of Cake, cm</i>	<i>Time for Cooking, Min</i>	<i>Colour of Cake</i>
18	30	Brown
23	35	Brown

The cakes shall rise symmetrically and a slightly domed shape shall be permitted.

Ideally there shall be no variation for colours between top and undersides when considered together but a reasonable departure from this ideal shall be permissible.

## 26 COMBUSTION TEST

**26.1** When tested in accordance with Annex D, on no account the carbon monoxide and carbon dioxide ratio of the exhaust gases of any burner operating at any consumption at which the burner is stable at gas inlet pressure from 25 gf/cm<sup>2</sup> to 35 gf/cm<sup>2</sup> shall exceed 0.02.

**26.2** The carbon dioxide and carbon monoxide contents of the products of combustion shall be determined by the methods capable of an accuracy of 0.05 percent and 0.001 percent, respectively of the volume of the sample.

## 27 SURFACE TEMPERATURE

### 27.1 Floor, Wall and Ceiling Temperature

In addition to the relevant requirements given in 23 of IS 5116, the requirements given in 27.2 and 27.3

shall apply.

**27.2** Surfaces other than working shall not attain temperature 100°C above the room temperature. The oven being held at 280°C for 2 h prior to measuring surface temperatures. Various points to check the surface temperatures are shown in Fig. 4.

**27.3** Surfaces intended to be handled during operation of an appliance shall not attain temperatures likely to cause discomfort in use after 2 h operation. The oven being held at 280 °C for 2 h prior to measuring surface temperatures.

## 28 CLASSIFICATION OF TESTS

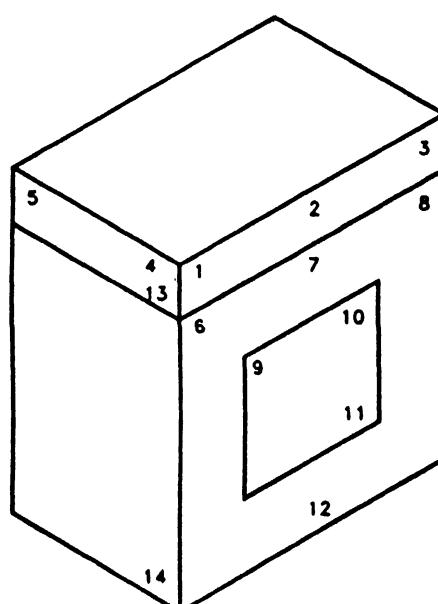
**28.1** The following tests shall constitute type tests:

- a) Test on doors (see 13);
- b) Flash back test for materials of burner (see 5.2 of IS 5116);
- c) Resistance to draught (see 22);
- d) Oven heat distribution (see 24);
- e) Victoria sandwich cake baking test (see 25);
- f) Combustion test (see 26); and
- g) Surface temperature (see 27).

### 28.2 Routine Tests

The following shall be carried out as routine tests:

- a) Gas soundness (see 18);
- b) Ignition and flame stability (see 21); and
- c) Thermostats (see 23).



4, 5, 13 and 14 Both Sides of Oven

FIG. 4 POINTS FOR DETERMINATION OF SURFACE TEMPERATURES OF OVENS

### SECTION 3 GENERAL

#### 29 INSTRUCTIONS

Each oven shall be accompanied by an instruction card or cards giving the following information:

- a) Brief instructions for installation and regulation which include piping and siting of flue terminal, if any;
- b) Gas consumption in kcal/h with commercial LPG;
- c) Special instructions, if any, for correct operation of the appliance;
- d) Manufacturer's name, initials or registered trade-mark;
- e) For use with commercial LPG at 30 gf/cm<sup>2</sup>;
- f) Special instructions, if any, for the safe operation; and
- g) Country of origin.

#### 30 MARKING

30.1 Each oven shall have a durable rating plate fixed to it showing the following:

- a) Manufacturer's name, initials or registered trade-mark;

- b) For use with commercial LPG at 30 gf/cm<sup>2</sup>;
- c) Special instructions, if any, for the safe operation;
- d) Country of origin; and
- e) Temperature chart corresponding to the thermostat setting, if thermostat is provided.

30.1.1 The information given in 30.1 shall be distinct, permanent and easily accessible when the oven is installed as it would be in service.

#### 30.2 BIS Certification Marking

The ovens may also be marked with the Standard Mark.

30.2.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The details of conditions under which the license for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from Bureau of Indian Standards.

#### 31 PACKING

The ovens shall be packed as agreed to between the purchaser and the supplier, taking care of safety requirements as such during handling and transit to protect against damages.

### ANNEX A

#### ( *Foreword* )

#### IMPORTANT DEVIATIONS BETWEEN EN 30 : 1979 AND CORRESPONDING INDIAN STANDARDS

The European Standard EN 30 : 1979 covers most of the requirements covered in IS 4246, IS 4473, IS 4760 and IS 11480 read in conjunction with IS 5116.

The following are the deviations:

- a) Due to continuous upgradation of the Indian Standard, the thermal efficiency of gas stoves are now specified as 64 percent minimum. Indian Standard also provided for declaration of thermal efficiency on the nameplate, if it is 68 percent or above. The corresponding value in EN 30 is 58 percent.
- b) The gas consumption is measured using air in Indian Standard for better repeatability and reproducibility compared to gas in European Standard.
- c) Keeping in view of the cooking practices in India and the safety of the users, the Indian Standard limits the flame temperature at a particular height from the top of the pan support. Such test is not available in the European Standard.
- d) Though both the standards are permitting a slight amount of leakage of gas in the appliance, the Indian Standard test method is through bubble leak indicator and the European Standard is by actual measurement. The rate of leak permitted in the European Standard is higher than the quantity specified in Indian Standard.
- e) The European Standard specifies the limit of carbon monoxide in the product of com-

bustion. The product of combustion is measured by carbon monoxide and carbon dioxide ratio in Indian Standard.

f) The Indian market has liquefiable petroleum gas (LPG) as the cooking gas. European countries have three different families of

gases for the same purpose. Hence the European standard specifies the appliance which can be used and/or converted to other families of gases. Liquefiable petroleum gas (LPG) is categorized in the third family of gases and the production of appliances in India would be applicable only to this family.

## ANNEX B

*(Clause 2)*

### LIST OF REFERRED INDIAN STANDARDS

<i>IS No.</i>	<i>Title</i>	<i>IS No.</i>	<i>Title</i>
292 : 1983	Leaded brass ingots and castings ( <i>second revision</i> )	5116 : 1996	Domestic and commercial equipment for use with LPG — General requirements ( <i>third revision</i> )
319 : 1989	Free cutting leaded brass bars, rods and sections ( <i>fourth revision</i> )	6480 : 1988	Glossary of terms relating to domestic and commercial gas burning appliances ( <i>first revision</i> )
410 : 1977	Cold rolled brass sheet, strip and foil ( <i>third revision</i> )		
1458 : 1965	Railway bronze ingots and casting		
3488 : 1980	Brass bars, rods and sections suitable for forging ( <i>first revision</i> )		

## ANNEX C

*(Clauses 23.2, 23.3 and 23.4)*

### METHOD FOR TESTING THE REQUIREMENTS OF THERMOSTATS

#### C-1 PROCEDURE

**C-1.1** The appliance under examination shall be fed with commercial LPG at a normal working pressure of  $2\ 942\ kN/m^2$  ( $30\ gf/cm^2$  approximately). At several setting between the lowest on the scale and the highest normally used the effect on the static temperature of the increase in gas pressure of  $0.490\ kN/m^2$  ( $5\ gf/cm^2$ ) at the inlet of the appliance shall be noted by means of a thermocouple placed in the centre of a 50 mm blackened copper sphere. Temperature shall be recorded after the equilibrium reaches.

**C-1.2** Setting of the thermostat at the bottom, middle and top of the normal working range selected and at each of these settings, after equilibrium conditions have been established and recorded, the thermostat shall be turned down several settings and then up to

the original setting. Equilibrium shall be allowed to become established again and the temperature recorded as before by means of a thermocouple placed in the centre of a 50 mm blackened copper sphere. For each setting of the thermostat, two equilibrium temperatures of the oven shall be recorded; one in which the oven has reached its temperature from a lower temperature, and the other in which the oven has reached its temperature from a higher temperature.

**C-1.3** Commercial LPG at  $2\ 453\ kN/m^2$  ( $25\ gf/cm^2$ ) inlet pressure shall be used and oven left full 'ON' to enable temperature equilibrium to establish. The thermostat setting shall be the highest possible. Then the control knob shall be turned sharply to its lowest position and the flames examined. The flame shall not extinguish by this process.

## ANNEX D

(Clause 26.1)

TEST METHOD FOR DETERMINATION OF  
CARBON MONOXIDE/CARBON DIOXIDE RATIO

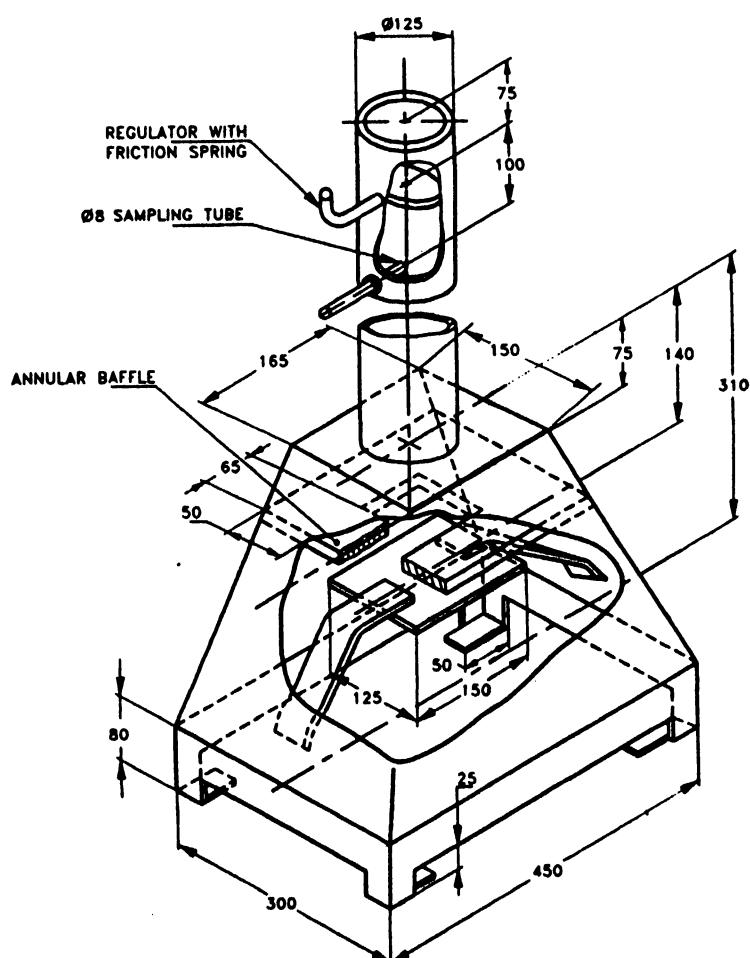
## D-1 PROCEDURE

D-1.1 The oven shall be set up in accordance with 20. In addition, however, a collection hood (see Fig. 5) suitable for the burners under examination shall be obtained. The hood shall be so designed that while not interfering in any way with the normal combustion of the burner it collects a fairly high proportion of the products of combustion. Also, it shall be such that the sample collected represents the whole of the combustion gases and not those from any particular point. When using hood, the damper provided shall be set or additional flue pipe added, so that spillage of the flue gases around the skirt is just prevented. With the sample hood in position over the burner under investigation, LPG at inlet pressure of 25 gf/cm<sup>2</sup> shall be admitted and the burner operated for a few minutes before sampling commences. The reason for this being

that during the first few minutes the burner is warming up and the proportion of carbon monoxide may be high. However, this is not dangerous provided the burner works satisfactorily after heating up.

D-1.2 Any of the recognized methods may be used for gas analysis. For carbon monoxide, it is recommended that iodine pentoxide method or catalytic method; for example, Drager, Katz or infra red analysis methods may be used. Carbon dioxide may be tested with an Orsat apparatus, the Haldane apparatus or by infra red analysis.

D-1.3 Each burner shall be examined at 25 gf/cm<sup>2</sup> to 35 gf/cm<sup>2</sup> pressure. It shall also be noted that each burner is tested with each or all the possible combinations of the other burners operating.



All dimensions in millimetres.

FIG. 5 HOOD FOR OVEN

**ANNEX E**  
**( *Foreword* )**  
**COMMITTEE COMPOSITION**

**Domestic and Commercial Gas Burning Appliances (Pressure Type) Sectional Committee, ME 23**

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